

ABSTRACT OF INVENTION

A planar laser illumination and imaging (PLIIM) based camera system for producing high-resolution 3-D images of moving 3-D objects having arbitrary surface geometry. The PLIIM-based camera system comprises a system housing of unitary construction, a LADAR-based object profiling subsystem, a PLIIM-based linear imaging subsystem, and an image processing subsystem disposed therein. The system housing has first, second, third and fourth light transmission apertures linearly aligned with and optically isolated from each other, and the third light transmission aperture is disposed between the first and second light transmission aperture. The LADAR-based object profiling subsystem projects an amplitude modulated (AM) laser beam through the fourth light transmission aperture, and scans the laser beam across an 3-D object surface of arbitrary surface geometry moving past the fourth light transmission aperture. The return AM laser beam is processed in order to measure the surface profile of the moving 3-D object surface and produce a series of linear 3-D surface profile maps thereof. Each linear 3-D surface profile map comprises a set of 3-D coordinates specifying the location of sampled points along the moving 3-D object surface. The PLIIM-based linear imaging subsystem produces a series of linear high-resolution 2-D images of the moving 3-D object surface. Each linear high-resolution 3-D image comprises a set of pixel intensity values, and each pixel intensity value is assigned a set of two-dimensional coordinates specifying the location of the pixel in the linear high-resolution 2-D image. The image processing subsystem automatically processes the linear 3-D surface profile maps and the high-resolution 2-D linear images captured by the subsystems in order to construct high-resolution 3-D images of the 3-D object surface. By virtue of the present invention, it is now possible to produce high-resolution 3-D images of moving 3-D object surfaces using linear imaging and 3-D profiling techniques.